Transesophageal echocardiography for surgically corrected pulmonary venous baffle obstruction after Senning repair

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We present a case of D-transposition of great arteries with a ventricular septal defect for which the child required balloon atrial septostomy at 1 month of age and was later taken up for Senning's procedure at 2 years of age. The patient remained asymptomatic up to 7 years after surgery. At 9 years of age, this child presented to us with a history of recurrent episodes of cough with expectoration and hemoptysis for 1 year. Transthoracic echocardiography confirmed pulmonary venous baffle stenosis with a peak gradient of 17 mmHg and a mean of 5 mmHg. Intraoperative transesophageal echocardiography indicated a peak gradient of 25 mmHg. The stenotic area was excised and augmentation was performed using homologous pericardium. Intraoperative transesophageal echocardiography confirmed adequate correction.

Keywords:
post-Senning repair, pulmonary venous baffle stenosis, transesophageal echocardiography

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Introduction

Atrial-level repair for transposition of great arteries in the form of the Senning or the Mustard procedure can be complicated at a later age by right ventricular dysfunction, sinus node dysfunction, atrial arrhythmias, systemic atrioventricular valve regurgitation, baffle problems in the form of obstruction or leaks, pulmonary hypertension, and even sudden death [1]. Baffle obstruction can be systemic venous baffle or pulmonary venous baffle stenosis (PVBS). PVBS after the Senning procedure has a reported incidence of 1.9–7.6% [2]. The treatment for PVBS is either by transcatheter balloon dilatation or surgical. We report a case of PVBS after Senning repair that was corrected surgically and confirmed using intraoperative transesophageal echocardiography (TEE).

Case report

We present a case of D-transposition of great arteries with a ventricular septal defect for which the child required balloon atrial septostomy at 1 month of age and was later taken up for Senning's procedure at 2 years of age. The patient remained asymptomatic up to7 years after surgery. At 9 years of age, this child, weighing 17 kg, presented to us with recurrent episodes of cough with expectoration and hemoptysis for 1 year. He had a history of dyspnea on exertion, which was controlled with tablet spironolactone 6.25 mg thrice daily. Transthoracic echocardiographic evaluation indicated dilated right atria and right ventricle, with moderate right (systemic) ventricular dysfunction [Ejection fraction (EF): 35–40%], prepared left ventricle with normal function, and PVBS with a peak gradient of 17 mmHg and a mean of 5 mmHg. PVBS was confirmed by cardiac catheterisation and the patient was planned for corrective surgery.

The patient was premedicated with syrup promethazine 0.5 mg/kg orally 2 h before surgery. After confirming fasting status, the patient was shifted to the operation room. Pulse oximetry, noninvasive blood pressure monitoring, ECG monitoring, and cerebral oximetry using near-infrared spectroscopy monitoring were started. Intravenous access was achieved using a 20 G cannula. Anesthesia was induced with ketamine 2 mg/kg and fentanyl 2 μg/kg. Endotracheal intubation was facilitated with rocuronium bromide 1 mg/kg and the trachea was intubated with a 6.0 cuffed endotracheal tube; intermittent positive pressure ventilation was instituted to maintain eucapnia. The left femoral artery was cannulated for invasive arterial pressure monitoring and a central venous catheter was placed into the left femoral vein. The right groin was kept free, in case there was a need for emergency femorofemoral bypass. A temperature probe and a pediatric TEE probe were placed. In addition, urine output, activated coagulation time, arterial blood gases, hematocrit, serum electrolytes, and blood glucose monitoring were instituted. Anesthesia was maintained on fentanyl, midazolam, pancuronium, and isoflurane in an oxygen–air mixture.

Intraoperative TEE confirmed turbulence in the pulmonary venous atrium, suggesting mid-baffle stenosis (Fig. 1), with a peak gradient of 25 mmHg (Fig. 2).

Sternotomy was performed. Careful dissection was performed in view of extensive adhesions. After aortic cannulation, superior vena cava (SVC) and left atrial appendage were cannulated in view of extensive adhesions. The cardiopulmonary bypass (CPB) was instituted and antegrade cardioplegia was administered. The procedure was performed under deep hypothermic circulatory arrest at 16°C. The stenotic area was excised and augmentation was performed using homologous pericardium. The total CPB time was 171 min, the aortic cross-clamp time was 38 min, and the total circulatory arrest period was 30 min. After CPB, hemodynamics was maintained on an infusion of dopamine 5 µg/kg/min, dobutamine 5 µg/kg/min, and nitroglycerine 0.5 µg/kg/min.

The postoperative TEE showed a significant improvement in the stenosis with a gradient of 2 mmHg (Fig. 3).

The patient developed supraventricular tachyarrhythmia, for which amiodarone was initiated in the postoperative period. He was extubated on postoperative day 3 and discharged on postoperative day 5. He is asymptomatic, and in sinus rhythm on follow-up.

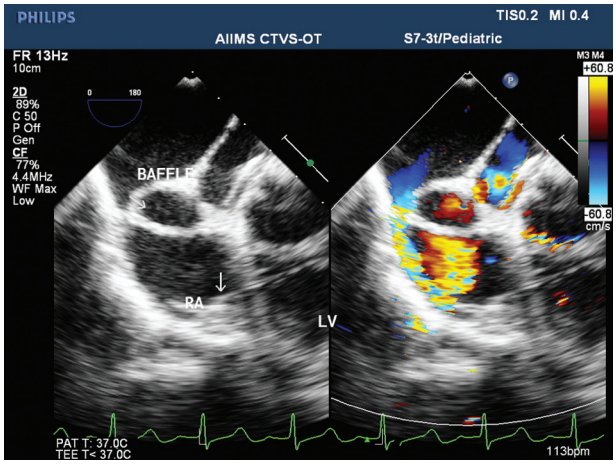
Discussion

Systemic venous baffle obstructions are more common with Mustard repair compared with pulmonary venous baffle obstruction, which is more common with Senning's procedure. The obstruction in PVBO occurs commonly between the inferior vena caval baffle-limb and the lateral atrial wall [1].

Doppler echocardiography represents a reliable technique for the assessment of pulmonary venous atrial pressure flow after the Mustard or the Senning procedure [3]. It aids the detection of the site of baffle obstruction, isolated stenosis of the pulmonary vein, and to monitor changes after surgery. Except in neonates and young infants, it is difficult to sample all four veins independently using TTE [3]. TEE is thus essential in diagnosis as well as guiding the surgeon on adequate repair using Doppler.

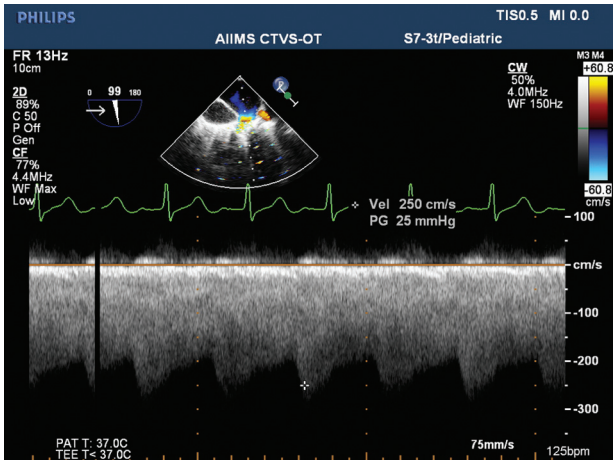
Both systemic venous baffle stenosis and pulmonary venous baffle obstruction can be treated with

Figure 1



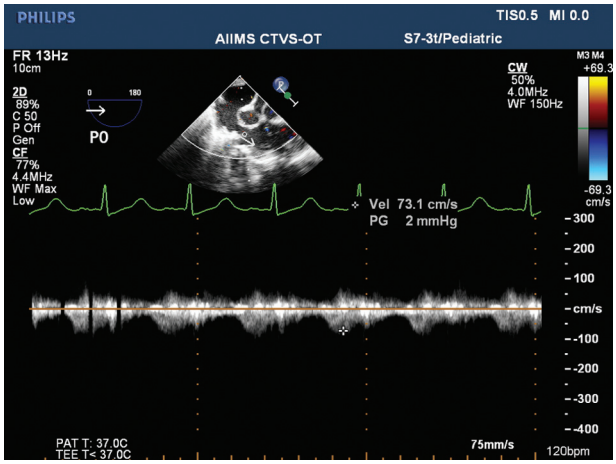
Transesophageal view at mid-esophageal level at 0 degree, probe rotated right side with colour compare showing turbulence suggestive of pulmonary venous baffle stenosis. RA: Right atrium; LV: Left ventricle.

Figure 2



Transesophageal view at mid-esophageal level between 90–100 degree showing gradient of 25 mmHg across the baffle obstruction.

Figure 3



Transesophageal view at mid-esophageal level at 0 degree showing gradient of 2 mmHg after surgical correction of baffle obstruction with homologous pericardium.

transcatheter dilatation/stenting [1] or surgically and, recently, a hybrid procedure has also been described for the same [4]. Superior vena cava obstructions have been repaired successfully by stent placement unlike PVBS because direct access to the target obstruction is not possible in PVBS [4]. Transseptal puncture is difficult and time consuming in calcified, scarred baffles. In addition, transseptal or transbaffle access may be complicated by residual leaks through the baffle that requires occlusion devices [4]. Because of documented lower success with stenting/dilation, we planned to manage our case surgically.

Calcification and retraction of the right atrium can cause the stenosis of the baffle [2]. This was probably the cause in our case as well. The juxtaposition of the auricles of the atria and the small right atrium could also have contributed toward baffle stenosis [2].

To conclude, TEE plays an essential role in the intraoperative management of such cases. It aids preoperative confirmation of diagnosis, defining the peak and the mean gradient across the obstruction, site of obstruction, visualizing flow across the systemic and pulmonary veins, and postoperatively, to assess adequacy of repair. The absence of turbulence and fall in the peak as well as the mean gradient across the site of obstruction define successful repair. In our case, turbulence decreased as well as peak pressures decreased from 25 to 2 mmHg.

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Conflicts of interest
There are no conflicts of interest.

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